

Patent Claims:

1. An apparatus for measuring material removal during a polishing or grinding process, said apparatus comprising:
- 5 a. a substantially circular rotatable grinding or polishing pad; and
- b. a sample holder; and
- 10 c. a sample with a top surface, a bottom surface and one or more side surfaces;
- wherein the sample holder is arranged to hold the bottom surface of the sample in contact with the grinding or polishing pad; the sample holder being connected to a moving device to move the sample to a position at least partially over the rim of the grinding or polishing pad, during at least a part of the grinding or polishing process; said apparatus further comprising a detecting device for sampling, at the position at least partially over the rim of the grinding or polishing pad, the distance between a reference mark and a plane defined by the bottom surface of the sample during the process; and
- 20 said detecting device is connected to a device for storing and/or comparing said distance with a stored reference distance between the reference mark and a target area in the sample.
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2. An apparatus according to claim 1 wherein the reference mark is constituted by a point, a line substantially parallel to the surface of the grinding or polishing pad, an orifice substantially parallel to the surface of the grinding or polishing pad, a plane
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substantially parallel to the surface of the grinding or polishing pad, preferably said reference mark is placed on or in connection with the sample and/or the sample holder.

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3. An apparatus according to claim 1 wherein the target area is constituted by a plane, a line, a spot/mark/point.

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4. An apparatus according to claim 1 wherein the detecting device to detect the distance between the reference mark and a plane defined by the bottom surface of the sample is a scanning laser micrometer or a combination of two laser displacement sensors.

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5. An apparatus according to claim 1 wherein the sample diameter is at least 20 mm, preferably 25 to 50 mm and more preferably 30 to 40 mm.

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6. An apparatus according to claim 1 wherein the sample holder comprises a goniometric mechanism for three-dimensional adjustment of the sample prior to the polishing or grinding process.

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7. An apparatus according to claim 1 wherein the apparatus further comprises a moving device for moving or sliding the sample holder over the surface of the grinding or polishing pad, said moving device is connected to the sample holder and capable of moving or sliding the sample holder in a desired pattern e.g. a radial, a circular, or a rotating pattern.

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8. An apparatus according to claim 1 wherein the sample holder is adapted to contain more than one sample,

preferable the sample holder is adapted to contain 3 to 12 samples and more preferably 3 to 6 samples.

9. An apparatus according to claim 1 wherein the device
5 for storing and/or comparing the measured or detected distance during the grinding or polishing process is a computer.

10. An apparatus according to claim 1 wherein the
10 detecting device to detect the distance between the reference mark and a plane defined by the bottom surface of the sample comprises a laser displacement sensor.

11. A method of preparing materialographic samples,
15 comprising using an apparatus according to claim 1.

12. A method of polishing wafers comprising using an apparatus according to claim.

20 13. A method for grinding or polishing a sample or silicon wafer on a substantially circular rotating grinding or polishing pad, which method comprises the steps of:

- 25 i. selecting an area of interest in the raw material to form the sample
ii. optionally resizing the raw material for example by cutting
iii. optionally mounting the raw material in a resin and
30 cure the resin to form a sample with a top surface, a bottom surface and at least one side surface, in which said an area of interest is substantially within an area near the bottom surface
iv. placing the sample in a sample holder

- v. identifying a reference mark
- vi. identifying a target area in the sample
- vii. aligning the target area in the sample in three dimensions with respect to the reference mark when the target area is a line or plane
- viii. measuring the reference distance from the target area in the sample to the reference mark and storing the said reference distance in a storing device
- ix. placing the sample holder with the sample on a grinding or polishing pad, with the bottom surface of the sample in contact with the surface of the grinding or polishing pad
- x. optionally grinding or polishing the bottom surface of the sample in at least one step removing material in an amount to bring the bottom surface of the sample near to the target area in the sample
- xi. grinding or polishing the bottom surface of the sample until the plane defined by the bottom surface is congruent/coincident with the target area while controlling the removal of material by measuring the distance between the plane defined by the bottom surface and the reference mark and comparing the measured distance with the stored reference distance
- xii. stopping the grinding or polishing of the bottom surface when the distance between the plane defined by the bottom surface and the reference mark is equal to the stored reference distance.

14. A method according to claim 13 wherein a planar surface substantially parallel to the surface of the grinding or polishing pad is used as reference mark, said planar surface being the upper part of the sample and/or the sample holder.

15. A method according to claim 13 wherein more samples are placed in the sample holder and grinded or polished simultaneously, preferably 3 to 12 samples are placed in the sample holder.

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16. A method according to claim 13 wherein the distance between the plane defined by the bottom surface and the reference mark is measured at a position where the sample is moved with the sample holder to be at least partly over the rim of the grinding or polishing pad.

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17. A method according to claim 13 wherein the distance between the plane defined by the bottom surface of the sample and the reference mark is measured with a scanning laser micrometer or a combination of two laser displacement sensors.

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18. A method according to claim 13 wherein the reference distance is stored and compared to the distance measured between the plane defined by the bottom surface of the sample and the reference mark in a computer.

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19. A method according to claim 13 wherein the sample is a materialographic sample.

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20. A method according to claim 13 wherein the sample is a silicon wafer.

21. An apparatus for measurement of material removal during a polishing or grinding process, said apparatus comprising:

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a. a rotatable grinding or polishing pad having a rim;

b. a sample holder arranged to hold a sample with a top surface, a bottom surface and one or more side surfaces, the sample holder being arranged to hold the bottom surface of the sample during at least a part of the polishing or grinding process in contact with the grinding or polishing pad; and wherein the sample holder comprises a reference mark;

c. a moving device connected to the sample holder, wherein the moving device is adapted to position the sample holder during at least a part of the polishing or grinding process at a position at least partially over the rim of the grinding or polishing pad;

d. a detecting device for sampling, at the position at least partially over the rim of the grinding or polishing pad, the distance between the reference mark and a plane defined by the bottom surface of the sample during the process; and

e. a control device connected to the detecting device for comparing said distance with a reference distance between the reference mark and a target area in the sample.

22. An apparatus according to claim 21; further comprising a detecting device for measuring the reference distance between the reference mark and a target area in the sample; and wherein the control device comprises a storage device for storing the measured reference distance.

23. An apparatus according to claim 21, further comprising a cleaning station for cleaning the sample; and wherein the moving device is arranged to position the

sample in operational contact with the cleaning station before positioning the sample at said position at least partially over the rim of the grinding or polishing pad.

- 5 24. An apparatus according to claim 23, further comprising a drying station for drying the sample; and wherein the moving device is arranged to position the sample in operational contact with the drying station before positioning the sample at said position at least
10 partially over the rim of the grinding or polishing pad.